

Alternative Employment, Women Participation In Seaweed Farming And Livelihoods Of Small-Scale Fishing Community In Zanzibar

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Abstract

Seaweed farming is an alternative livelihood option for the small-scale coastal fishing communities in Zanzibar. More than 80% of the women are engaged in seaweed farming and contribute to livelihoods of small-scale fisher households. The seaweed farmer faces some challenges such as lack of finance, frequent seaweed die-offs, consequence of climate change and social conflict between seaweed farmers and other marine resources users. The study aims to examine how women participation in seaweed farming contributes to the livelihoods of seaweed farmers in Zanzibar. A face to face survey was conducted to obtain data for the study from the selected respondents using a structured questionnaire. The study used partial least square (PLS) technique and regression analysis. The results of the study showed that seaweed farmers have greater access to livelihood assets and increased household income. The study recommends that it is important for the government to take into consideration for the provision of financial assistance, production equipment and training for livelihood improvement of small-scale fisher households in Zanzibar.

Key Words: Seaweed Farming, Livelihoods, Production, Government, Zanzibar

1. Introduction

Seaweed production generates a huge economic value that contributes to the livelihoods of fisher households and support national economy (Riatiga et al., 2017). Seaweed farming generates alternative employment and income opportunities for the poor fishing households and used as an instrument for food security and poverty (Nor et al., 2017; Mirera et al., 2020). Seaweed industry brings foreign income to the coastal regions (Kamuli & Amin, 2018). Previous literatures indicated that seaweed farming improves socioeconomic benefits to the coastal communities (García-Poza et al., 2020).

The seaweed production process usually favours small scale farmers compared to the large-scale. The high achievement of small scale seaweed farmers brought by easy way of cultivation (Irfan

et al., 2020). The production process applied simple technology with small capital investment (Zulham et al., 2018). Seaweed cultivation favoured farmers in the area with low rainfall which is among characteristic of the coastal regions (Kim et al., 2017). The market opportunity of seaweed is always opened due to the alternative uses of seaweed. Seaweed used for direct consumption or raw material in other industries (Rauf et al., 2021).

Seaweed farming is the best alternative occupation to the small scale fishers in the coastal areas who are lack with employment options (Sriwulandari et al., 2020). The traditional life of coastal communities endowed by lack of education. Most of indigenous are incapable with administrative jobs, the best option is working on marine activities. Unfortunately, fisheries sector affected by overexploitation of marine resources and most of small scale fishers shifted to the seaweed cultivation (Plageron, 2020). Therefore, seaweed

farming creates considerable employment opportunity and income for their households (Eggertsen & Halling, 2021) and contributes beyond economic benefits to the coastal communities (Tano, 2016).

The Island of Zanzibar is the third biggest exporter of seaweed in the world and the second largest producer in Africa, after South Africa. Seaweed farming contributes about USD 8 million to the Zanzibar economy and is categorised as the important economic sector (Ephrahim et al., 2018). About 79% of seaweed are produced at Pemba Island and Micheweni District in the island contributing about two third of Zanzibar seaweed production (Msuya et al., 2022).

In Zanzibar, seaweed farming has become an alternative livelihood occupation among coastal villagers (Valderrama 2012; Mantri et al. 2017), about 80 percent of the farmers are women.

The sector suggested as major marine economic activity that has been continuing for more than fifty years (Charisiadou et al., 2022). Zanzibar seaweed farming operation began in 1930s when seaweed harvested from the wild (Songwe et al., 2016). By 1950s, about 4,000 tons of dried seaweed had been produced in the Island. However, the effective commercial seaweed cultivation commenced in Unguja Island in 1989 and serious engagement expanded to Pemba Island in 1994 (Hurtado, 2017). Both islands (Unguja and Pemba) specialized with two carrageenan species, which are *Eucheuma denticulatum* and *Kappaphycus alvarezii* (Msuya, 2013).

This effective cultivation of seaweed in Zanzibar forced by fishing decline due to the overfishing and marine resources degradation (Eggertsen & Halling, 2021). Seaweed farming nowadays is an important industry contributes significant value to the GDP. Zanzibar reported as among the largest exporter of seaweed, a part of Philippines and Indonesia (FAO, 2012). Zanzibar economy accounted the seaweed farming as largest marine export product, contributing about 97% per annum (Msuya, 2017). Seaweed farming provide opportunity of generating income that support livelihood to the households in terms of food and other basic needs and majority beneficiary are women (Kimathi et al., 2020). The income

generated from seaweed farming has allowed them to improve their living standard in several ways (Val-derrama et al., 2013). They can send their children to school, buying clothes and food and engaged in entrepreneurial activities (Msuya, 2012).

Currently however, the industry struggle to remain as a major economic activity due to many constraints. Farmers are lack with equipment for cultivation, poor drying facilities, lack of market as well as other economic and institutional constraints (Charisiadou et al., 2022). Hence, seaweed farming conducted at near sea, large swathes of seaweed are dying attributed by high temperature condition resulted by climate change (Cleyndert et al., 2021). Deeper water cultivation suggested as a best solution but unfortunately, about 90% of seaweed farmers in Zanzibar are female and traditionally cannot swim properly (Makame et al., 2021). Zanzibar market for seaweed is monopsony, price quoted by suppliers with very little influence from farmers. The current price of dried seaweed sold directly to the suppliers is Tanzania shilling 600–800 per kilogram (Msuya, 2013). This price is lower compared to the price courted by other countries like Philippines and Indonesia (Valderrama et al., 2015).

Several remedial initiatives have been promoted by government and other stakeholders to improve seaweed farming (Msafiri, 2021). The most preferable are the provision of training and funds to the seaweed farmers for increase production and making high quality value added products such as seaweed powder soap, body oils, shampoos, spice for cake and other products (Semboja, 2021). Nowadays, there are some industries that produce local products such as seaweed jam, seaweed soaps, seaweed cosmetics such as body creams and massage oils, foods like seaweed cake, jams, puddings and salads (Msuya & Hurtado, 2017). Base on the information available concerning the economic benefits of seaweed farming worldwide, this study used to investigate the role of seaweed farming as alternative employment, women participation and livelihoods attainment of small-scale fishing community in Zanzibar.

2. Literature Review

2.1 Livelihoods of Seaweed Farmers

Over the last decades, livelihood approaches have been gained increasing importance and are used as one of the fundamental analytical tools to support livelihood particularly to the poor resource users at coastal areas (Yazdanpanah et al., 2021; Dai et al., 2019). Livelihood defined as a means of living using resources that are manipulated in various economic activities (Gichure et al., 2020). Livelihood associated with ability of resource user on utilizing particular resource and creating economic benefits (Das et al., 2015). The ability determined by health condition, skill and knowledge for creativity in conducting economic works (Salim et al., 2013). Livelihood associated with the capability of people on mobilizing resources that enable them to pursue any economic activity. The mobilization of resources enables the production that are necessary for their survival and longer-term well-being and thereby reduce the vulnerability of economic crises (Flamme, 2010). Livelihood built by flows of income that is adequate to meet the basic needs of households (Fuchs et al., 2019; Gibbens & Schoeman, 2020).

Seaweeds are marine plants that applied low technological need for plantation, harvesting and drying. The farming are short growth output period taking 6 to 8 weeks depending on the culture method used (Mirera et al, 2020). Seaweed farming is an economic activity provide livelihood benefits and socioeconomic development to the coastal people

(Slater et al, 2017). Seaweeds farming is precedence economic sector in marine resources that bring economic benefits compared with other regular economic activities available at coastal areas (Valderrama et al, 2013; Arias-Echeverri et al., 2022).

Seaweed farming has appeared as the most applicable livelihood strategy empowered by strengthening farmers institutional or interagencies coordination (Jayaweera, 2010). The institutional commitment are basis for translating all aspects of seaweed farming and provide tangible benefits to the farming communities (Yusuf & Arsyad, 2015). Recognizing its potential to uplift the socio-economic status of marginalized coastal populations, international development agencies

began promoting seaweed farming particularly at rural villages (Agyarko, 2017).

2.2 Seaweed Product Usage.

Seaweed farming is conducted at different countries but particularly Philippine, Brazil, Indonesia, Malaysia, South Africa and Zanzibar (Hedberg et al., 2018). Global seaweed farming is dominated by the red seaweeds (*Kappaphycus* and *Eucheuma*) followed by the brown algal genus *Laminaria*, including *Saccharina* (FAO, 2016). The global cultivation of the red seaweed was started in the Philippines in the 1960s. While most cultivation in Africa was undertaken in Western Indian Ocean regions (Msuya & Hurtado, 2017).

Primarily, seaweed is a product that have multiple uses. The product can be used direct for human consumption or can be processed at the industry into value added products (Godoi et al., 2021; Kumar, 2018). Seaweed farming creates number of benefits include, the provision of employment opportunity to the coastal people, providing the varieties of finished products such seaweed jam, seaweed soaps, seaweed cosmetics such as body creams and massage oils, and the provision of foods like seaweed cake, jams, puddings and salads GomezZavaglia et al., 2019). Other industrial products include perfumes, shampoos, toothpaste, medicines, ice cream, milk shakes, and yoghurt (Sudarwati et al., 2020). The sector is a chief continuous supplier of raw material and fertiliser, the products used for seaweed-based industries and other industries (Kılınç et al., 2013; Hayet et al., 2021). The seaweed farming also used on reducing the pressure on depletion of ecosystem services acting as a tool for reducing coastal pollution hence the seaweed plants are major contributors of carbon dioxide (Rameshkumar & Rajaram, 2018).

The increasing of world population causing the attention of socioeconomic matters like food security due to its inverse relations with number of people. The concern of food security is not only about its provision, the issue is about its sustainability (FAO, 2018). Therefore, for achieving sustainable food provision, any production system should consider economic, social and environmental dimension (Grote et al., 2021). Seaweed farming meets this criteria hence, has been

considered as a sector which have sustainable form of production (Pereira et al., 2021). The product has been called the promising plant of the millennium due to its comparative advantages based on biomass production (Stévant & Rebours, 2021). The production do not necessitate fresh water, fertilisers, pest-insect or fungicides in order to grow (Hasselström et al., 2020). Nowadays seaweed farming cultivation techniques being economical viable because have been standardized and improved (Msuya et al., 2022). Seaweed farming has a greater socioeconomic contribution through its power of sustainable supply of quantity and quality of industrial raw materials and value-added products (Krishnana & Kumar, 2010).

2.3 Seaweed Socioeconomic Benefit.

The consumption of seaweed products is very essential in terms of human health and this benefit can be derived either direct and indirect (Cotas et al., 2021). The direct health benefits associated with the consumption of the particular seaweed in term of natural (Msuya et al., 2022). As indirect, seaweeds can be used as a natural fertiliser in agricultural cultivation and bring nutrient soil. The natural fertiliser reduces the application of chemicals fertilizer and avoiding the contaminated products (Lomartire & Gonçalves, 2021). The literatures contained much circumstantial evidences about socioeconomic prosperities and livelihood benefits of seaweed farming to the household farmers (Peñalver et al., 2020). Most of them habitually lived at or below the poverty line prior engaging in seaweed farming (Ateweberhan et al., 2018).

Through income generating from seaweeds, most farmers have experienced substantial improvement of their livelihood. Farmers can meet their basic needs wisely, enhance their diets through consumption of quality foods and manage health services. Also, can modifying their living houses condition, increasing their purchasing power of material goods and other economic needs (Msuya et al., 2022). Seaweed farming has had a remarkable positive outcome, especially socioeconomic status of the farmers particularly female. The sector is friendly, easily and applicable that allowed women to engage and can be undertaken without neglecting

traditional household responsibilities including family care (Larson et al., 2021).

Previous studies have investigated the socioeconomic impact of seaweed farming at different levels of economic outcomes (Rebours et al, 2014). The positive socioeconomic impact of seaweed farming have been documented in different countries including the Philippines, Indonesia, Brazil, Mexico, Tanzania, and Pacific Islands (Grantham, 2015). Based on references, seaweed farming is identified as a significant source of income for individual household of coastal regions. Seaweed farming identified as a means of employment and a means of women empowerment in coastal regions

(Ginigaddara et al, 2018). The literatures suggested that in Zanzibar, the adoption of seaweed farming was highly successful (Jonsson, 2017). The sector improving the livelihood of farmer households compared with the previous period before engagement in seaweed farming (Msuya, 2017). However, poor levels of economic performance of seaweed farming has also been reported in some other countries. For example, in Mexico seaweed farming is not attractive compared with other marine resource activities (Valderrama et al., 2013).

2.4 Challenges Encounter Seaweed Farming.

The previous literatures observed the number of challenges encounter the seaweed farming operation (Bak et al., 2020). Seaweed farmers face an innumerable number of challenges associated with occurrence of predation by herbivorous fishing and tropical storms. One of the main effect encounter seaweed farming is diseases such as epiphyte infestation and ice-ice disease (Tahiluddin & Terzi, 2021). These diseases affecting the production capacity of the farmers, ultimately the livelihood of farmers whose relying on seaweed farming for their livelihood are deteriorated (Loureiro et al., 2017). The increasing of seaweed diseases on seaweed farms causes the productivity declining (Msuya and Porter 2014; Cottier-Cook et al. 2016; Largo et al. 2020). The result is lack of sufficient return which threatening the empowerment of farmers on feeding their family (Msuya 2013).

Economically, major challenge encounter seaweed farmers are uncertainty and volatile of market condition. The seaweed price is always low that cannot meet the labourer effort put by the farmer for seaweed cultivation. The lower price always caught by the middlemen and the farmer has low chance of bargaining and less option (Gustafsson & Sivard, 2020). The low price imposed to the farmers drawn attention to negative socioeconomic impacts. Lack of equitable price causes low income, poor living standard and vulnerability of poverty to the seaweed farmers (Krishnan & Narayanakumar, 2013).

Seaweed farms mostly run by household members or by the community in the village which mostly consist members from the same village. The probability of occurring the conflicts within the family or between villagers is higher (Msuya, 2011). Seaweed farming community sometimes affected by lack of skills and experience on different fields of seaweed farming operation. They lack with formal skills such as marketing, financing or accounting while acquiring such skills for economic activity survive is necessary. Seaweed farmers who mostly live in coastal area lack with intensity on the uses of modern technology and lack of the basic knowledge about modern seaweed cultivation. The farmers are limited with source of capital for financing their farming operation (Teniwut & Teniwut, 2018). Seaweed farming conducted in the marine areas while same areas are dependent by the small-scale fishers causes social conflict among the resource users. Seaweed farms may be destroyed by fishing boats when put the farms in navigation roots. However most of conflicts were sorted through consultation by local government leaders and community leaders.

2.5 Hypothesis Development

In Zanzibar, seaweed farming is mostly a part-time activity whereby, about 80% of the farmers engaged in other labours intensive activities such as fishing and farming. Most of seaweed farmers are small scale fishers, joining in the seaweed farming favoured by seaweed production cycle and farming procedures that normally take place during low tides in fisheries (Charisiadou et al., 2022). However, about 50% of income generated by coastal people who have dual economic activities

come from seaweed farming (Rebecca et al., 2021). Seaweed farming is best alternative economic activity for improving livelihood condition to the seaweed farmer households. The livelihood attainment to the farmers associated with different source of income and determined by access of livelihood assets, access of modern production techniques and equipment with the great support from government.

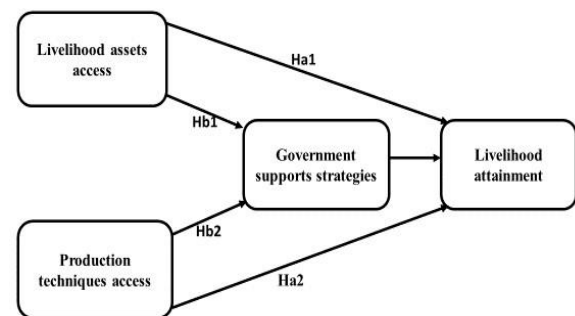


Figure 1: Conceptual Framework

The previous literatures discovered a great potential for seaweed farming when some factors are well addressed and managed (Ateweberhan et al., 2015). These factors including the access of livelihood assets by farmers, access of appropriate and modern production techniques and equipment and government support to the farmers (Ephrahim et al., 2018). These measures may promote accessible production, rising income level of farmers and better livelihood of their households. Based on these criteria the study hypothesised that:

- i The access of livelihood assets has a significant positive relationship with the livelihood of seaweed farmers in Zanzibar.
- ii The access of seaweed production techniques has a significant positive relationship with the livelihood of seaweed farmers in Zanzibar.
- iii Government support strategies mediating the relationship between access of livelihood assets and livelihood attainment to the seaweed farmers in Zanzibar.
- iv Government support strategies mediating the relationship between access of seaweed production techniques and livelihood attainment to the seaweed farmers in Zanzibar.

3 Material and Methods

3.1 Study Area

Zanzibar Island comprised by two main islands; Unguja and Pemba with other fifty small isles around the coastal areas of Indian ocean. The islands lie between latitude $04^{\circ} 50''$ and $06^{\circ} 30''$ in southern part, and between longitude $39^{\circ} 10''$ and $39^{\circ} 50''$ in eastern part. Unguja is a greater island compared with Pemba by covering area of 1,666 square kilometres against 988 square kilometres of Pemba Island forming a total of 2,654 square kilometres. The participants were chosen from specific villages, whereby for Unguja Island, Bwejuu and Paje villages were targeted areas and for Pemba Island, Msuka and Tumbe villages were focused area. The villages from Unguja Island are located in the south-east part of the island or in the east coastal of Zanzibar. While both villages from Pemba Island located at northern part of Pemba Island. The people from these villages are major seaweed producers compared to other areas in the coastal of Zanzibar.

3.2 Study Design

This study adopted a quantitative survey design using semi-structured questionnaire for data collection. Data were collected for three months consecutively, from April, 2022 to June, 2022 using simple random sampling techniques. The respondents were provided all necessary information concerning the study. The author allowed participants to be free on express their opinion about the seaweed farming operation. The additional information provided by participants concerning the seaweed farming practices was used in the study as preliminary consent. Most of respondents were interviewed at their farming areas, the convenience place for both parties, given a wide awareness about seaweed production process to the researcher and free expression from the participants. Few numbers of participants were interviewed at their residence's areas where by other process of seaweed farming are take place especially dried process.

3.3 Measurement of the Variables

The study adopted number of constructs to measure the influence of independent variables to dependent variable. The study used two independent variables which were the access of livelihood assets in the seaweed farming and the access of seaweed production techniques and equipment. The study taken government support strategies as a mediating variable. The dependent variable was livelihood attainment through access of different source of income by the seaweed farmers.

4. Results

4.1 Assessment of Measurement Model

Using partial least square analysis, the assessing of measurement model is the first stage. The step tends to ascertain the goodness of measures of the model (Mohajan, 2017). The section involved an evaluation of the reliability and validity of the model's variables. Hair et al., (2020) suggested that the evaluation of reliability and validity of the model involves the assessment of relationships between the latent variables and their associated items. This can be done using factor loading (FL), average variance extracted (AVE), composite reliability (CR) and Cronbach Alpha (α) (Hair et al., 2020). The accepted value for factor loading, average variance extracted, composite reliability, and Cronbach Alpha were greater than 0.6, 0.5, 0.7 and 0.6, respectively (Hair et al., 2019). This study used those values as recommended by different literatures (Hair et al., 2020; Schubert, 2021; Ali et al., 2018). The results from this study showed that out of 36 items used in measuring the four constructs, five items were dropped and deleted from the study, while 31 items were remained and regarded as acceptable for further analysis as shown in the table 1.

Table 1: The acceptable items based on FL, AVE, CR and Cronbach's Alpha value

Latent construc t and items	Factor loadin gs	Averag e Varianc e Extract ed (AVE)	Compos ite Reliabili ty (CR)	Cronbac h's Alpha
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Access of livelihood assets	0.782	0.938	0.85
LVA1	0.820		
LVA2	0.854		
LVA3	0.805		
LVA4	0.824		
LVA5	0.725		
LVA7	0.712		
LVA9	0.857		
Access of seaweed production techniques	0.794	0.942	0.86
PTA 2	0.889		
PTA 3	0.894		
PTA 4	0.907		
PTA 6	0.898		
PTA 7	0.859		
PTA 8	0.698		
PTA 9	0.783		
Government support strategies	0.769	0.921	0.81
GSS 1	0.868		
GSS 2	0.837		
GSS 3	0.855		
GSS 4	0.869		
GSS 5	0.865		
GSS 6	0.901		
GSS 7	0.764		
GSS 8	0.802		
GSS 9	0.711		
Livelihood attainment	0.773	0.927	0.83
LVT 1	0.869		
LVT 2	0.879		
LVT 3	0.740		
LVT 4	0.703		
LVT 5	0.725		
LVT 6	0.848		
LVT 7	0.866		
LVT 8	0.856		

4.2 Assessment of Structural Model

The next step after assessing the measurement model was evaluation of structural model. Based on this analysis the researcher depended on the suggestion mentioned by previous literature (Sarstedt et al., 2022). This step gives way to examine the standardized path that are coefficients for the purpose of evaluating the hypotheses. The adjusted R-square value is one of the vital criterion and the most commonly utilized measurement during evaluating the relationships of constructs in the PLS-SEM model (Hair et al., 2011). The adjusted R-square value represents the variance explained in each endogenous latent construct as described by the criterion construct and is a measure of the model’s explanatory power. The results of adjusted R-square value of 0.536 indicated that endogenous variable accounted for 54% of the variability. This is means that the livelihood attainment to the seaweed farmers have been explained by 54% on the factors like the access of livelihood assets and access of production techniques and equipment. The remaining 46% may be explained by other variables as exogenous. The alternative relevant model fitness indices used include goodness of fit index (GFI), comparative fit index (CFI), normed fit index (NFI) and root means squared error of approximation (RMSEA). The values of CFI = 0.979; NFI = 0.975; NFI = 0.966 and RMSEA = 0.068 suggested that data fitted the proposed model and satisfactory allowed the researcher for further analysis of testing the hypothesis.

Table 2: Standardize Regression weight

Hypothesis	Variable	Coefficient	p-value	Remarks
Ha ₁	Access of livelihood assets	0.325	0.000**	Accepted
Ha ₂	Access of production techniques	0.236	0.000**	Accepted

Note: t -values $> 1.65^*$ ($p < 0.10$); t -values $> 1.96^{**}$ ($p < 0.05$); t -values $> 2.58^{***}$ ($p < 0.01$)

Referring with the results of table 2, the value of $\beta = 0.325$, $p < 0.000$ suggested the positive and significant relationship between access of livelihood assets and livelihood attainment by the seaweed farmers through different sources of income, therefore the researcher failed to reject the hypothesis one. Either, the value of $\beta = 0.236$, $p < 0.000$ suggested the positive and significant relationship between access of production techniques and equipment and the access of livelihood attainment through various source of income, therefore the researcher failed to reject the hypothesis two. The study measured the mediating role of government support strategies in relation to the access of livelihood assets and livelihood attainment. The results showed that the inclusion of mediating variable resulted the declining of beta values from (0.326 to 0.149) but significant with p -value 0.000. Based on mediating rules (Hair et al., 2010; Hair et al., 2011), the access of livelihood assets was partially supported by mediation of government support strategies on the livelihood attainment by the seaweed farmers. The inclusion of mediating variable resulted the declining of beta values from (0.236 to 0.049) but insignificant with p -value 0.314. Based on mediating rules, the access of production techniques was fully supported by government support strategies on livelihood attainment by the seaweed farmers.

5. Discussion

The study revealed from the hypotheses the positive relationship between the access of livelihood assets on contributing to the livelihood of seaweed farmers. The access to various financial support such as credits from formal and informal financial institutions, saving from various sources and grants increased source of income to the farmers which results better livelihood condition. This results also indicated that seaweed farmers have a greater chance of improving their livelihood condition in access of human assets. The access of skill, knowledge, experience and better health condition improved livelihood of seaweed

farmers by performing any labour-intensive economic activity and generating more income. The social assets including good relationship, trust and hospitality are important on determining livelihood. Seaweed farmers have the opportunity of acquiring supports including food and other livelihood options based on their good cooperation within society. This condition can keep the farmer better-off and comfortable at the time of economic crises in term of money kinds. When seaweed farmers build a network with different backgrounds, can create the perfect awareness and market opportunity. Market is people and people are sought after, so getting to know more people is the right way of searching a market for seaweed products. Seaweed farmers may have advantages of selling their product under the expansion of network with different suppliers. This led to a better average sales and income that can meet the needs of their households. The study revealed the positive relationship between access of production techniques and equipment with livelihood attainment. Proper seaweed production techniques are among the key factors that lead in producing quality and sufficient seaweed. Considering that seaweed produced in the sea, and sea temperature tends to change frequently, seaweed farmers need to know the marine environmental condition so as to determine the right time for cultivate seaweed. Apart of right time, farmer should consider the best seeds to use and other modern tools needed. Proper drying techniques are also required, this led the harvesting of seaweed with good condition. The consideration of these measures helped the seaweed farmer to sell best quality and in large quantity of seaweed and earn sufficient income that can meet the livelihood needs.

The government intervention on seaweed farming is very important for improving the livelihood condition of seaweed farmer households. Seaweed farmers lack with financial supports, there are limited with credits facilities that farmers can acquired. Most of farmers are incapable with loan condition from banks based on level of income they have. The banks should consider about the rate of interest that is

affordable by farmers. The government may provide subsidies to the farmers in terms of farming equipment including boats. Also, may provide the training and workshops for better seaweed farming and other entrepreneurial skills. These factors may improve the livelihood condition of farmers by generating additional income that can meet the basic needs for farmer households.

6. Conclusion

The seaweed farming is the third economic sector in Zanzibar on contributing foreign income apart from clove production and tourism. Seaweed farming contributing significantly to the employment opportunity to the coastal villagers especially women. In Zanzibar, seaweed farming is an alternative economic activity to the most of marine resource users. Seaweed farming is important economic occupation and contributing to the livelihood of farmers and their livelihoods. This study discovered the access of livelihood assets and production techniques and equipment as important factors on determining the livelihood of seaweed farmers in Zanzibar.

Data were collected from sample of seaweed farmers on various aspects such as household source of income, household assets endowment and production techniques applied. Primary data were collected using structured questionnaires and secondary data concerning socioeconomic status of seaweed farmers and seaweed cultivation were collected from published reports provided by government entities particularly Zanzibar Statistic Unit and Zanzibar National Planning Commission. The linkages between the access of livelihood assets and production techniques and equipment as a predictor of access to the livelihood attainment though different sources of come to the seaweed farmers were tested and analysed using different statistical tools including SPSS and AMOS. The study discovered that both predictors have positive and significant contribution to the livelihood of seaweed farmers as a means of generating additional sources of income. The study revealed that the livelihood of seaweed farmers depends primarily on strong seaweed farming and its value-added products. The access of financial assets,

human assets and social assets are much important on improving the livelihood of seaweed farmers. The application of better production techniques and modern equipment in the seaweed cultivation resulting best quality and quantity of seaweed. Also, the study found the significance of government support strategies on access of livelihood assets and farming techniques and equipment for improving the livelihood condition of seaweed farmers.

Zanzibar have launched national development planning called vision 2050 after the former development planning of vision 2020. Based on the new plan, blue economy taken as a priority targeted for the next 30 years, serving as an effective and sustainable means of improving the livelihood condition of rural people with effective economic growth of the State. Hence the seaweed farming is an important component of blue economy, the study recommends to the government based on policy development considering the promoting the sector. The current establishment of government seaweed company was among the most requisite. The company may take a role of supporting the farmers from ground on cultivation. Production tools, dried equipment and storage facilities should be in provision hence most farmers suffering with this primary equipment. The company have provided boats to smooth production, regular supervision is important for fulfilling the target. The company may be a regulator to the seaweed middlemen and negotiating reasonable price for the sake of farmers. The company can mobilize international market of seaweed and its industrial products. For achieving the goals, the government should empower the company by employing staff with high technical ability. Other measures that may taken by the government are the provision of financial support to the farmers, the provision of subsidies on other equipment and the regular training about the current and better methods of seaweed cultivation and drying process.

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Data Availability Statement: The data used in this study were obtained from a questionnaire administered to selected number of seaweed farmers from Zanzibar coastal area.

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